

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

ECE2066 – OPERATING SYSTEMS
(CE)

15 OCTOBER 2019
2:30 P.M. - 4:30 P.M.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This examination paper consists of 6 pages with 4 questions only.
2. Answer **ALL** the 4 questions. The distribution of marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

Question 1 (25 marks)

- (a) (i) Define **program** and **process** in the context of operating system. [2 marks]
- (ii) Discuss FOUR (4) reasons for process creation. [4 marks]
- (iii) A Process Control Block (PCB) is a collection of attributes needed by the operating system to control the process. List and discuss THREE (3) types of information which are managed by the PCB. [6 marks]
- (b) What is Multithreading? Discuss TWO (2) advantages of threads as compared to processes. [3 marks]
- (c) Four jobs listed in Table Q1(c) are to be executed on a single processor computer with 4096 Megabyte of memory. The jobs can be implemented either using the uniprogramming or multiprogramming scheme. Assume that virtual memory is not used in the case of multiprogramming. Compare the jobs implemented in both uniprogramming and multiprogramming in terms of the following:
- (i) Processor usage (%) [4 marks]
- (ii) Memory usage (%) [2 marks]
- (iii) Throughput (number of jobs per hour) [2 marks]
- (iv) Mean response time. [2 marks]

Table Q1(c): Job descriptions

	JOB 1	JOB 2	JOB 3	JOB 4
Type of job	Heavy I/O	Light I/O	Light I/O	Heavy computation
Processor usage	20%	15%	10%	50%
Duration	15 minutes	20 minutes	25 minutes	30 minutes
Memory required	100 MB	300 MB	200 MB	500 MB
Printer usage	Yes	No	No	Yes

Continued...

Question 2 (25 marks)

- (a) Explain the necessary and sufficient conditions for deadlock to occur in a multithreaded application.

[8 marks]

- (b) Peterson's Algorithm is the software solution for mutual exclusion. Figure Q2(b) shows the snapshot of coding for Peterson's Algorithm:

Figure Q2(b): Peterson's Algorithm

```
Process Pi:
repeat
    flag[i]:=true; // i want
in
    turn:=j; // but i let j
in

    while
        (flag[j]&turn=j) {} ;
    CS
    flag[i]:=false; // i no
longer want in
```

- (i) Define the term **Mutual exclusion**. Subsequently, explain how mutual exclusion can be preserved based on the coding in Figure Q2(b).

[5 marks]

- (ii) Based on Figure Q2(b), discuss how the progress and bounded waiting requirements of mutual exclusion can be satisfied.

[6 marks]

Continued...

- (c) Table Q2(c) shows the snapshot of a system. Determine whether deadlock is detected in the system.

Table Q2(c).1: Available resources in the system

	Resources			
	R1	R2	R3	R4
Quantity	2	1	1	0

Table Q2(c).2: Resources assigned to the processes

Process	Resources			
	R1	R2	R3	R4
P1	0	0	1	0
P2	2	1	0	1
P3	0	1	2	0

Table Q2(c).3: Resources still needed by the processes

Process	Resources			
	R1	R2	R3	R4
P1	2	1	0	1
P2	0	0	1	0
P3	2	1	0	0

[6 marks]

Continued...

Question 3 (25 marks)

- (a) Dividing main memory into a set of non-overlapping regions is called partitioning. Compare the differences between fixed partitioning and dynamic partitioning. [4 marks]
- (b) (i) List THREE (3) objectives of CPU scheduling. [3 marks]
- (ii) Discuss each of the following criteria in the context of CPU scheduling:
- (I) CPU utilization [2 marks]
 - (II) Throughput [2 marks]
 - (III) Turnaround time [2 marks]
- (c) Suppose that five processes (P1, P2, P3, P4, and P5) arrive at time 0 and are ready to be executed. Table Q3(c) shows the burst time of the processes:

Table Q3(c)

Processes	Burst Time (millisecond)
P1	4
P2	6
P3	2
P4	3
P5	7

- (i) Describe the operation of each of the following scheduling algorithm. Then apply the algorithms for the processes in Table Q3(c). Draw the respective Gantt Chart which shows each process's schedule. You must also show the working steps.
- (I) First-Come, First-Served (FCFS) [2 marks]
 - (II) Shortest-Process-Next (SPN) [2 marks]
 - (III) Highest-Response-Ratio-Next (HRRN) [5 marks]
- (ii) Calculate the average waiting time for each of the algorithm in Q3(c)(i). [3 marks]

Continued...

Question 4 (25 marks)

- (a) Describe THREE (3) categories of input/output (I/O) devices. Give an example for each category. [6 marks]
- (b) A file system is used to control how data is stored and retrieved. Name THREE (3) modern file systems. [3 marks]
- (c) Suppose a file system adopts the size of 4 kilobyte block size. With the help of suitable diagrams, explain how two files of 12 kilobyte and 20 kilobyte may be stored using each of the following disk blocks allocation techniques:
- (i) Contiguous allocation. [4 marks]
 - (ii) Chained allocation. [4 marks]
 - (iii) Index-node (i-node). [4 marks]
- (d) Consider a file system that uses in-memory file allocation table for indexing the disk blocks. Each table entry requires 4 bytes of storage. For a 4 terabyte disk and a 4 kilobyte block size, calculate the maximum memory size required to hold the file allocation table. Next, discuss the suitability of in-memory file allocation table for a system with large disks. [4 marks]

End of paper